Chapter 12
Data Presentation and Final Reports

12-1. Report Format

All surveying field work and analysis leads to a final presentation of the results. Contained in the final Survey Report are the field notes, supporting analysis, results, and a report of conclusions. The report format should include the following standard components.

a. Title page. The title page should list summary project information such as, the authorized project name, document reference number, date, and reference to the survey.

b. Introduction. This section summarizes the main results in abstract form, and presents an outline of the project report describing the purpose and execution of the survey.

c. Project description. Includes a description of the monitoring network using text, tables, and figures.

(1) Site plan that shows the layout of the structure superimposed with the monitoring network. Figures with plan or cross-sectional views showing the outline of the structure, location of deformation network points, and their names. All reference points shown in the figures will be denoted by one symbol, while all object points will be denoted by a different symbol.

(2) List of approximate coordinates for each network station giving,

- Station Name
- Point ID
- 3D coordinates

(3) Project features described and indexed in a summary paragraph, including,

- nature and definition of project datum
- number of stations
- designated sub-networks
- date of present survey
- list of previous surveys completed.

(4) Monument descriptions as to:

- type of monument
- recovery information
- physical condition
- reference marks.

d. Equipment. Inventory of equipment used to complete the survey, including:

- identification of each instrument model
- serial number.

e. Survey design. This section describes the features used in the design of surveys including:

- types of measurements
- redundancy
- stations measured
- observation weights

If preanalysis was conducted, a summary of the resulting output files can be substituted.

f. Computations and results. The results section will contain the following components.

(1) A summary list of:

- methods for data reductions
- calibration values
- initial and final measurement values

(2) A list of the final coordinates for each station along with associated point confidence ellipses,

(3) A list of the calculated positions for the most recent prior survey. These results also will be tabulated in digital form independent of the report.

(4) Graphical displays of the network with horizontal and vertical displacements will include point movements plotted as vectors with their associated error bars and/or error ellipses. Statistically significant movements will be flagged. Only displacements between two chosen epochs will be plotted on a given figure. Displacement contours will not be plotted.

(5) Reference network stability analysis showing results of independent monitoring of the reference network stations.

(6) Cumulative displacements will be reported. Final reports will include figures showing 1D cumulative displacements of critical points in critical directions versus time. Examples of critical cumulative displacements include movements in the downstream and vertical directions of a small number of points on the crest of a dam, or movements in the downhill and vertical directions of a small number of representative points in a earthen dam or levee. The error bar associated with each displacement will be plotted. Data from all deformation analyses performed on the project will be included. Statistically significant cumulative displacements will be flagged.

g. Conclusions. Comparison of the displacements and displacement accuracy to the expected values for structural movement. Discussion of the overall quality and accuracy of the survey.

h. References. Any additional source material should be referenced. An index to the archived digital data and field notes should be provided.

i. Network adjustment. Adjustment results will be reported as a separate section. The final report will include a tabular summary of each network adjustment including the following information:

- network constraints applied,
- names of points used, or point ID numbers,
- adjusted point coordinates to the nearest 0.1 mm,
- standard deviations of point coordinates to the nearest 0.1 mm,

- dimensions of error bars to the nearest 0.1 mm at the one standard deviation level for 1D network points.
- dimensions of the axes of the error ellipses to the nearest 0.1 mm (one standard deviation),
- orientation angle to the nearest 0.1 degree for 2D network points,
- dimensions of the axes of the error ellipses to the nearest 0.1 mm,
- out-of-plane angles to the nearest 0.1 degree for 3D network point coordinates,
- quadratic form of the residuals,
- total redundancy of the network,
- estimated a posteriori variance factor.
- standardized residuals for each observation,

j. Initial and final surveys. Final reports of calculated displacements will include:

- a summary of coordinate data from both adjustments used to compute final displacements.
- displacements reported to the nearest 1 mm and associated direction to the nearest 0.1 degree.

12-2. Displacement Data Presentation

a. General. Regular use of engineering illustrations and other visual aids such as, graphs and plots, give an immediate picture of the structure's behavior. It is equally important to have tabulated displacement values, accuracy evaluations, and data quality indicators that support the reliability and significance of the results. Each single epoch displacement vector should be plotted on a schematic of the structure along with its associated point error ellipse for the base epoch. To enhance clarity, vertical movement components are plotted on a separate elevation view.

b. Data plots. Various types of summary data plots can be used for interpreting the structural displacement time history.

(1) Most recent epoch. For plots of the most recent survey epoch, the displacements are compared to the initial baseline survey (to indicate total net movement). The actual displacements are compared against the maximum amount of expected movement.

(2) Critical areas. Detailed plots can be made for areas that require greater attention, such as structural or foundation interfaces.

(3) Trend plots. Cumulative trends in the coordinate data sets from year to year should be computed to determine if the movement behavior is consistent over time. Displacement velocity and acceleration trends can refine the frequency needed for future surveys.

12-3. Data Management

a. General. The organization and management of historical movement data should be given high priority on deformation monitoring projects because information about the structure has to be kept for a long period of time. This information may also need to be retrieved on short notice in the event of problems with the structure. One strategy for data management is to create a dedicated database file system to archive project survey information.

b Data management. Database systems can quickly extract and summarize dam status information, and the data can be used to produce graphs, written reports, or specific status summaries on demand. These systems sort and organize large volumes of data for generally any attributes that can be listed in table form. It is also an ideal format to archive raw survey data and to store processed results in a permanent file. The database also simplifies project management tasks by tracking annual progress, setting work priorities, schedules, and recording costs. Standardized dam status record-keeping also enables comparisons of structural performance from projects throughout USACE.

12-4. Mandatory Requirements

There are no mandatory requirements in this chapter.